

Notice of Allowability

Application No.

10/595,579

Applicant(s)

HAM, CORNELIS LEONARDUS
GERARDUS

Examiner

Tiffany A. Fetzner

Art Unit

2859

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 6/8/2007 & telephonic interview of 12/21/2007.
2. ☒ The allowed claim(s) is/are Examiner amended claims 2-5 and 7-21.
3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☒ All b) ☐ Some* c) ☐ None of the:
 1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☒ Interview Summary (PTO-413),
Paper No./Mail Date 12/26/2007.
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

Examiner's Amendment

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.
2. Authorization for this examiner's amendment was given in a telephone interview with **Attorney Tom Kocovsky Reg. No. 28, 383** on **December 21st 2007**, along with authorization to charge any necessary fees to applicant's deposit account.
3. The application has been amended as follows:

A) Replace claims 2 through 5 of the June 8th 2007 amendment and response with the following Examiner amended claims 2 through 5:

Claim 2 --- A gradient coil system according to ~~claim 4~~ **claim 7**, wherein the one Z primary coil-like element is placed between the at least two X primary coil-like elements and the at least two Y primary coil-like elements in such a way that at both sides of the Z primary coil-like element there is arranged at least one X primary coil-like element and at least one Y primary coil-like element such that the cooling fluid flowing through the Z-gradient coil hollow conductors indirectly cools ing the at least two X and Y primary coil-like elements.---

Claim 3 --- A gradient coil system according to **claim 2**, wherein the one Z primary coil-like element is placed between the at least two X primary coil-like elements and the at least two Y primary coil-like elements in such a way that at one side of the Z primary coil-like element there is arranged a first X primary coil-like element and a first Y primary coil-like element, and that at the other side of the Z primary coil-like element there is arranged a second X primary coil-like element and a second Y primary coil-like element.

Art Unit: 2859

Claim 4 --- A gradient coil system according to **claim 7**, further including: at least two X shield coil-like elements, at least two Y shield coil-like elements and one Z shield coil-like element, wherein the one Z shield coil-like element is placed between the **at least two** X shield coil-like elements and the **at least two** Y shield coil-like elements. ---

Claim 5 --- A gradient coil system according to **claim 4**, wherein the one Z shield coil-like element is placed between the at least two X shield coil-like elements and the at least two Y shield coil-like elements in such a way that at both sides of the Z shield coil-like element there is arranged at least one X shield coil-like element and at least one Y shield coil-like element. ---

B) Replace claim 7 through 21 of the June 8th 2007 amendment and response with the following **Examiner amended claims 7 through 21**:

Claim 7 --- A cylindrical MRI gradient coil system, comprising at least two X primary coil-like elements, at least two Y primary coil-like elements and one Z primary coil-like element providing a modular, variable FOV gradient coil system, wherein the one Z primary coil-like element is made from hollow conductors, and that the one Z primary coil-like element is directly cooled by a cooling fluid flowing through said hollow conductors, and wherein the at least two X primary coil-like elements have mutually different linearity volumes by themselves or in combination with each other, the at least two Y primary coil-like elements have mutually different linearity volumes by themselves or in combination with each other, and the one Z primary coil-like element is placed between the **at least two** X primary coil-like elements and the **at least two** Y primary coil-like elements. ---

Art Unit: 2859

Claim 8 --- A gradient coil system according to **claim 7**, wherein the at least two X primary coil-like elements and the at least two Y primary coil-like elements are positioned on both sides of the one Z primary coil-like element and are indirectly cooled by said directly cooled Z primary coil-like element. ---

Claim 9 --- A gradient coil system according to **claim 4**, wherein the one Z shield coil-like element is made from hollow conductors, and the one Z shield coil-like element is directly cooled by a cooling fluid flowing through said hollow conductors. ---

Claim 10 --- A gradient coil system according to **claim 9**, wherein the at least two X shield coil-like elements and the at least two Y shield coil-like elements positioned around the one Z shield coil-like element are indirectly cooled by the directly cooled Z shield coil-like element. ---

Claim 11 --- A gradient coil system according to **claim 5**, wherein the at least two X primary coil-like elements, the at least two Y primary coil-like elements and the one Z primary coil-like element provide an inner coil arrangement, that the at least two X shield coil-like elements, the at least two Y shield coil-like elements and the one Z shield coil-like element provide an outer coil arrangement, and that a layer comprising epoxy with filler material and/or a GRP tube layer are positioned between the inner coil arrangement and the outer coil arrangement. ---

Claim 12 --- A gradient coil system according to **claim 11**, wherein the epoxy with filler material and/or a **GRP tube** layer is positioned adjacent the inner coil arrangement, and the epoxy with filler material and/or a GRP tube layer is **also** positioned adjacent the outer coil arrangement. ---

Art Unit: 2859

Claim 13 --- A gradient coil system according to **claim 11**, wherein a one of at least two X primary coil-like elements and the a one of at least two Y primary coil-like element are positioned between the one Z primary coil-like element and the epoxy with filler material and/or a GRP tube layer, and that the one of at least two X shield coil-like elements and the one of the at least two Y shield coil-like elements are positioned between the one Z shield coil-like element and the epoxy with filler material and/or a GRP tube layer. ---

Claim 14 --- A magnetic resonance imaging system, comprising a main magnet system, a gradient coil system, a RF system and a signal processing system, wherein the gradient coil system is a gradient coil system according to **claim 7**. ---

Claim 15 --- A cylindrical MRI gradient coil system surrounding an imaging volume comprising:

- a cylindrical Z primary coil-like element;

- a first cylindrical X primary coil-like element and a first cylindrical Y primary coil-like element concentrically disposed radially inside and abutting the Z primary coil-like element;

- a second cylindrical X primary coil-like element and a second cylindrical Y primary coil-like element concentrically disposed radially outward from and contiguous to the Z primary coil-like element;

- a cylindrical Z shield coil-like element disposed radially outward and displaced from the second cylindrical X primary coil-like element and the second cylindrical Y primary coil-like element;

- a first cylindrical X shield coil-like element and a first cylindrical Y shield coil-like element concentrically disposed radially inside and contiguous to the Z shield coil-like element and displaced from the second cylindrical X primary coil-like element and the second cylindrical Y primary coil-like element;

a second cylindrical X shield coil-like element and a second Y cylindrical shield coil-like element disposed concentrically outside the Z shield coil-like element. ---

Claim 16 --- The gradient coil system according to **claim 15**, wherein the Z primary coil-like element includes an electrically conductive tubular element through which a cooling fluid flows, the first and second cylindrical X and Y coil-like element being immediately thermally connected to the Z primary coil-like element such that the cooling fluid directly cools the Z primary coil-like element and indirectly cools **via the thermal connection** the first and second X and Y primary coil-like elements; and the Z shield coil-like element includes an electrically conductive tubular element through which a cooling fluid flows, the first and second cylindrical X and Y coil-like element being immediately thermally connected to the Z shield coil-like element such that the cooling fluid directly cools the Z shield coil-like element and indirectly cools **,via the thermal connection**, the first and second X and Y shield coil-like elements. ---

Claim 17 --- The gradient coil system according to **claim 15**, wherein the first and second X primary coil-like elements have mutually different linearity volumes (FOVs) by themselves or in combination with each other, and the first and second Y primary coil-like elements have mutually different linearity volumes (FOVs) by themselves or in combination with each other. ---

Claim 18 --- The gradient coil system according to **claim 17**, wherein the first and second X primary coil-like elements have different linearity volumes (FOVs) such that when the first and second X gradient coil assembly are used in combination with a gradient current of one polarity in the second X gradient coil, a first volume (V_{x1}) is

defined and such that when the first and second X primary coil-like elements are used in combination with a current of a second polarity opposite to the first polarity flowing through the second X primary coil-like element, a second volume (V_{x2}) is defined. ---

Claim 19 --- The gradient coil system according to **claim 18**, wherein the first and second Y primary coil-like elements have different linearity volumes (FOVs) such that when the first and second Y gradient coil assembly are used in combination with a gradient current of one polarity in the second Y gradient coil, a first volume (V_{y1}) is defined and such that when the first and second Y primary coil-like elements are used in combination with a current of a second polarity opposite to the first polarity flowing through the second Y primary coil-like element, a second volume (V_{y2}) is defined. ---

Claim 20 --- A cylindrical MRI gradient coil system surrounding an imaging volume including a primary coil assembly comprising:

- a cylindrical Z primary coil-like element defined of electrically conductive tubular elements configured such that current applied to the Z primary coil-like element causes a gradient magnetic field along a Z direction;

- a cooling fluid which flows through the hollow conductors of the Z primary coil-like element to cool the Z primary coil-like element directly;

- first and second X primary coil-like elements disposed on radially opposite sides of the Z primary coil-like element and immediately thermally coupled thereto to be indirectly cooled via the thermal connection by the cooling fluid flowing through the hollow conductors of the Z primary coil-like element, the first and second X primary coil-like elements being operative individually or in combination to define mutually different linearity volumes (FOVs); and,

first and second Y primary coil-like elements disposed on radially opposite sides of the Z primary coil-like element and immediately thermally coupled thereto to be indirectly cooled by the cooling fluid flowing through the hollow conductors of the Z primary coil-like element via the thermal connection, the first and second Y primary coil-like elements being operative individually or in combination to define mutually different linearity volumes (FOVs). ---

Claim 21 --- The gradient coil system according to **claim 20**, further including:

a structural support tube surrounding the primary coil assembly; and,
a cylindrical shield coil assembly surrounding and supported by the support tube, the shield coil assembly including:

a Z shield coil-like element defined of electrically conductive tubular elements configured such that current applied to the Z shield coil-like element causes a gradient magnetic field along a Z direction;

a cooling fluid which flows through the hollow conductors of the Z shield coil-like element to cool the Z shield coil-like element directly;

first and second X shield coil-like elements radially disposed on opposite sides of the Z shield coil-like element and immediately thermally coupled thereto to be indirectly cooled via the thermal connection by the cooling fluid flowing through the hollow conductors of the Z shield coil-like element, the first and second X shield coil-like elements being operative in combination with the first and second X primary coil-like elements; and,

first and second Y shield coil-like elements radially disposed on opposite sides of the Y shield coil-like element and immediately thermally coupled thereto to be indirectly cooled via the thermal connection by the cooling fluid flowing through the hollow conductors of the Z shield coil-like element, the first and second Y shield coil-like elements being operative in combination with the first and second Y primary coil-like elements. ---

The following is an examiner's statement of **Reasons for Allowance**:

4. With respect to **Examiner amended independent claims 7, 15, and 20**: These claims are considered to be allowable over the prior art of record because the prior art of record neither discloses nor suggests a modular, variable field of view, cylindrical MRI gradient coil comprising the entire combinational structure, as set forth by applicant. The prior art of record has either a fixed FOV gradient coil system or a different structural order to the components, so that the gradient coil components are not in the applicant's novel combinational order. . It is the entire combination of the claim limitations taken as a whole that constitutes both the novelty and non-obviousness of applicant's claims.

5. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Examiner's Comment

Priority

6. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Drawings

7. The corrected Figure 1 drawing submitted June 8th 2007 is accepted by the examiner.

Prior Art of Record

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

A) Teklemariam et al., US patent application publication **2005/0146330 A1** published July 7^h 2005, filed September 17th 2004 with an effective us priority date of September 19th 2003

B) Clarke et al., US patent application publication **2005/0030028 A1** published Feb. 10th 2005, filed August 7th 2003.

Art Unit: 2859

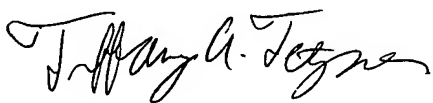
- C) **Clarke et al.**, US patent **7,015,692 B2** issued March 21st 2006, filed August 7th 2003.
- D) **Vavrek et al.**, US patent application publication 2004/0189298 A1 published September 30th 2004, filed April 7th 2004 with an effective us priority date of October 16th 2002.
- E) **Petropoulos et al.**, US patent **6,788,057** issued September 7th 2004, filed Feb. 22nd 2002, with an effective US priority date of Feb. 21st 2001.
- A) See the attached Notice of references cited.

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tiffany Fetzner whose telephone number is: (571) 272-2241. The examiner can normally be reached on Monday, Wednesday, and Friday-Thursday from 7:00am to 2:10 pm., and on Tuesday and Thursday from 7:00am to 5:30pm.

10. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Dean Reichard**, can be reached at (571) 272-1984. The **only official fax phone number** for the organization where this application or proceeding is assigned is **(571) 273-8300**.

11. Information regarding the status of an application may be obtained from the Patent Application information Retrieval (PAIR) system Status information for published applications may be obtained from either Private PMR or Public PMR. Status information for unpublished applications is available through Private PMR only. For more information about the PMR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PMR system contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



TAF
December 26, 2007



Brii Shrivastav
Primary Patent Examiner
Technology Center 2800
12.26.07